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Measuring e-Commerce Success: Applying the DeLone & McLean Information Systems Success Model

William H. DeLone and Ephraim R. McLean

ABSTRACT: Information technology and the Internet have had a dramatic effect on business operations. Companies are making large investments in e-commerce applications but are hard pressed to evaluate the success of their e-commerce systems. The DeLone & McLean Information Systems Success Model can be adapted to the measurement challenges of the new e-commerce world. The six dimensions of the updated model are a parsimonious framework for organizing the e-commerce success metrics identified in the literature. Two case examples demonstrate how the model can be used to guide the identification and specification of e-commerce success metrics.

KEY WORDS AND PHRASES: e-commerce, evaluation of information systems, information systems success, use of information systems, user satisfaction, value of information technology.

The Internet has dramatically affected the conduct of business. Markets, industries, and businesses are being transformed. The new economy demands the exploitation of new models and paradigms. Information technology (IT) now drives businesses and markets. In the new economy, the Internet has become a powerful and ubiquitous communication mechanism to facilitate the consummation and processing of business transactions. This has led to substantial changes in traditional industries and companies. Firms are attempting to understand and measure the impact of IT so that they can make intelligent decisions regarding crucial IT investments.

All this notwithstanding, basic business principles still hold. The laws of economics have not been rewritten. The long-term success or failure of companies is determined by their ability to generate positive net revenues. Similarly, there has been no change in the fundamental role of IT in facilitating business transactions and communicating relevant information to decision-makers. However, the decision makers now include customers, both internal and external. Time compression and the magnitude of change may be dramatic, but IT still has the same goals and objectives.

This paper proposes that even though new business models are emerging, the fundamental role of IT has not changed, and thus the methodology for measuring the success of information systems (IS) should not change. Although there are many new technological developments, the dependent variable—IS success—and its underlying dimensionalities are still the same. The DeLone & McLean IS Success Model is an existing success-measurement framework that has found wide application since its publication in 1992 [7]. With the addition of new metrics, an updated version of the model can be applied to e-commerce success measurement [8, 9].

For the purposes of this paper, e-commerce is defined as the use of the Internet to facilitate, execute, and process business transactions. Business

transactions involve a buyer and seller and the exchange of goods or services for money.

Updated DeLone & McLean Success Model

The original DeLone & McLean Success Model provided a comprehensive framework for measuring the performance of information systems [7]. The new and updated model is based on the empirical and theoretical contributions of researchers who have tested or discussed the original model [8, 9]. The updated model, presented in Figure 1, consists of six interrelated dimensions of information systems success:

- System quality
- Information quality
- Service quality
- Use
- User satisfaction
- Net benefits

The primary improvements to the original model include (a) the addition of service quality to reflect the importance of service and support in successful IS systems, and (b) the collapsing of individual impacts and organizational impacts into a more parsimonious net benefits construct.

Service Quality

In the original formulation of the DeLone & McLean model [7], the dual dimensions of system and information quality seemed sufficient to capture the essential characteristics of information systems being delivered to users. In the intervening decade, however, it became apparent that a third dimension was needed, service quality [8, 9]. As Pitt, Watson, and Kavan observed, "Commonly used measures of IS effectiveness focus on the products rather than the services of the IS function. Thus, there is a danger that IS researchers will mismeasure IS effectiveness if they do not include in their assessment package a measure of IS service quality" [32, p. 173].

This need has become even more apparent with the advent of e-commerce and the demand of customers for support from their Web providers. Thus, service quality is added to Figure 1.

Net Benefits

The new net benefits construct immediately raises three issues that must be addressed: What qualifies as a "benefit"? for whom? and at what level of analysis? The original formulation of the DeLone & McLean model used the term "impact." Seddon used "consequences" and "net benefits" in his characterization of outcomes [38]. We have come to prefer "net benefits" because the

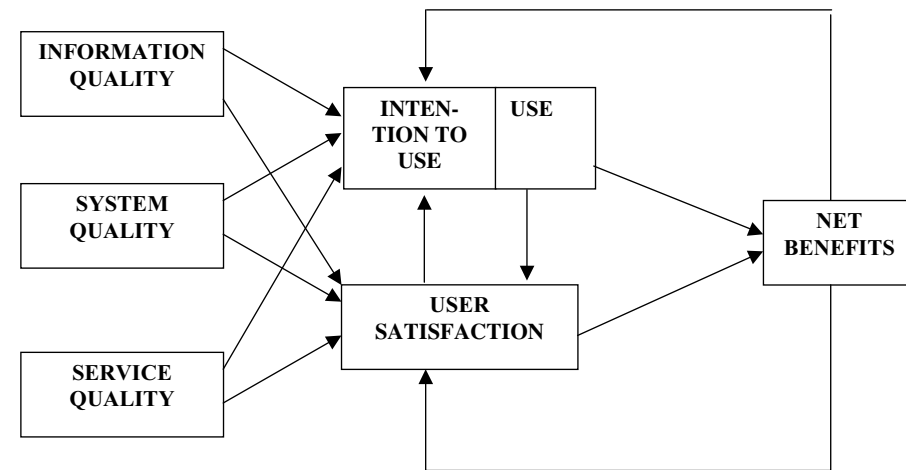


Figure 1. Updated DeLone & McLean IS Success Model.

original term, “impacts,” may be positive or negative, thus possibly leading to confusion as to whether the results are good or bad. In addition, the inclusion of “net” in “net benefits” is important, because no outcome is wholly positive and without any negative consequences. Thus, “net benefits” is probably the most accurate descriptor of the final success variable.

The second issue of concern is benefits for whom—the designer, the sponsor, the user, or others? Different actors or players may have different views of what constitutes a benefit. Thus, it is impossible to define net benefits without first defining the context or frame of reference. The fact that the DeLone & McLean model does not define the context is a matter of detail, not of oversight. The focus of any proposed study must be defined. The model may be useful to both Microsoft and the user community, but each may have a very different definition of what constitutes net benefits—and thus IS success—from its own perspective.

Finally, the level of analysis must be addressed. Are the benefits to be measured from the individual’s perspective, the employer’s, or that of the industry or of the nation? The challenge for the researcher is to clearly and carefully define the stakeholders and the context in which net benefits are to be measured.

The DeLone & McLean Success Model for e-Commerce Measurement

Since its publication in 1992, nearly 300 articles in refereed journals have referred to, and made use of, the DeLone & McLean IS Success Model as the basis for measuring the dependent variable in IS research [7]. The model is based on Shannon and Weaver’s classic communication theory, as adapted by Mason, to measure IS impacts [23, 40]. As a powerful communications and

commerce medium, the Internet is a communication and IS phenomenon that lends itself to a measurement framework (i.e., the DeLone & McLean model) built on communication theory. In the e-commerce context, the primary system users are customers or suppliers rather than internal users. Customers and suppliers will use the system to make buying or selling decisions and execute business transactions. These electronic decisions and transactions may affect individual users, organizations, industries, and even national economies.

Molla and Licker first proposed that the original DeLone and McLean model could be extended to measure e-commerce success [25]. This paper is based on the updated DeLone and McLean IS Success Model as revised in 2002 and extended in 2003 [8, 9]. Molla and Licker used the original DeLone and McLean model published in 1992 as a basis of their proposal [7, 25]. This paper adds the new construct of service quality and updates the important net benefits construct (i.e., individual and organizational impact constructs in the original model), and it provides an extensive list of success metrics based on a comprehensive review of e-commerce articles in the IS and marketing literature. It concludes with two case examples that demonstrate the utility of the proposed e-commerce success framework. Molla and Licker did not attempt to demonstrate the application of the model.

The six success dimensions of the DeLone & McLean IS Success Model can be applied to the e-commerce environment as follows:

1. *System quality*, in the Internet environment, measures the desired characteristics of an e-commerce system. Usability, availability, reliability, adaptability, and response time (e.g., download time) are examples of qualities that are valued by users of an e-commerce system.
2. *Information quality* captures the e-commerce content issue. Web content should be personalized, complete, relevant, easy to understand, and secure if prospective buyers or suppliers are to initiate transactions via the Internet and return to a site on a regular basis.
3. *Service quality*, the overall support delivered by the service provider, applies regardless of whether the support is delivered by the IS department or a new organizational unit or is outsourced to an Internet service provider. This dimension is more important in an e-commerce environment than ever before, because the users are now customers rather than employees, and therefore, poor user support will translate into lost customers and lost sales.
4. *Usage* measures everything from a visit to a Web site and navigation within the site to information retrieval and execution of a transaction.
5. *User satisfaction* is an important means of measuring customers' opinions of an e-commerce system and should cover the entire customer experience cycle from information retrieval through purchase, payment, receipt, and service.
6. *Net benefits* are the most important success measures, because they capture the balance of the positive and negative impacts of e-commerce on customers, suppliers, employees, organizations, markets, industries, economies, and even society as a whole. Have Internet purchases saved individual consumers time and money?

Have the benefits, such as larger markets, supply-chain efficiencies, and customer responsiveness, yielded positive net benefits for an organization? Have country investments in e-commerce infrastructure yielded a net positive growth in GNP? Have societal investments in e-commerce infrastructure and education reduced poverty?

Net benefits measures are determined by the context and objectives of the specific e-commerce investment. There will be a variety of e-commerce net benefits measures, but many will be the same ones that have been developed and tested for information systems investments in general.

Net benefits success measures are clearly important, but they cannot be analyzed and understood without system, information, and service-quality measurements. For example, in the e-commerce environment, the impact of a Web site design on customer purchases cannot be fully understood without an evaluation of the usability of the Web site and the relevance for purchasing decisions of the information provided to the prospective purchaser.

E-Commerce Metrics: Old and New

A review of articles on e-commerce and electronic data interchange (EDI) in recent academic and trade journals (1996–2002) yielded many suggested measures of e-commerce success. IS and marketing journals were included in the search for e-commerce success metrics. Most of the articles were conceptual in nature, but some were empirical and, therefore, attempted to operationalize e-commerce success metrics. Some of the proposed measures are IS measurement staples, whereas others have been newly developed for the e-commerce environment. Most important, all of the proposed measures can be classified under the six dimensions of the DeLone & McLean model.

The collections of e-commerce measures identified in the journals are discussed below under the relevant DeLone & McLean success dimensions. These e-commerce success measures are listed in Tables 1 through 7. The tables differentiate traditional management information systems (MIS) success measures that have been applied to e-commerce and new measures that have surfaced recently in the e-business environment. The e-commerce metrics identified in the tables are meant to be illustrative and not necessarily comprehensive.

System Quality

The system quality metrics for e-commerce shown in Table 1 are primarily the metrics that have been used in IS research for the last two decades. The key measures of system quality are still usefulness, usability, responsiveness, reliability, and flexibility. Some of the functionality item measures, such as versionability, are likely to differ in the e-commerce environment. What is different is the relative importance of the system-quality measures. When the users are customers as opposed to employees, their use is typically volitional, and this means that poor usability, usefulness, or responsiveness can discourage customer usage of an e-commerce system. Expected benefits are unlikely to be

Traditional MIS success measures	e-commerce source(s)
Usability, ease of use <ul style="list-style-type: none"> • Help features • Intuitiveness • Attractiveness 	Spiller & Lohse 1998; Molla & Licker 2001
Download time	<i>Liu & Arnett 2000</i> Spiller & Lohse 1998; <i>Palmer 2002</i>
System responsiveness, response time	Tiwana 1998; Molla & Licker 2001
Dependability, reliability, availability	<i>Liu & Arnett 2000</i> ; Tiwana 1998; Ünal 2000; Molla & Licker 2001
Adaptability, flexibility	
Usefulness, functionality <ul style="list-style-type: none"> • “Versionability” • Transaction capabilities • Environmental scanning • Customer feedback capability 	Reisenwitz & Cutler 1998; Varian 1997 Parsons et al. 1998 Achrol & Kotler 1999 Peppers & Rogers 1997; <i>Palmer 2002</i>
Security, secure transactions	Gupta et al. 1998; Ünal 2000
Scalability	
Interactivity	<i>Palmer 2002</i>
New e-commerce success measures	e-commerce source(s)
Customization	<i>Palmer 2002</i>
Ease of navigation	<i>Palmer 2002</i> ; Molla & Licker 2001
Privacy	Molla & Licker 2001
Security	Molla & Licker 2001

Table 1. E-Commerce System Quality Measures.

Notes: Traditional MIS success measures are listed in tables 1 to 7 in DeLone & McLean [7] or were cited in MIS literature in the early to mid-1990s. Sources listed in *italics* represent empirical studies with operationalized e-commerce metrics. E-commerce measures with no source citation in the right-hand column were found in the trade literature.

realized when system quality is unsatisfactory. In addition, system security becomes a more significant system-quality issue, because e-commerce is typically conducted over the Internet rather than a private, proprietary network.

Information Quality

Research articles on e-commerce have not devoted much attention to information-quality or content-quality success measures (*see Table 2*). Many of the traditional information-quality measures apply, especially relevance. When customers are the users, and customer-purchase decisions are the objective, new, dynamic personalization measures are important because of the mass customization developments occurring in sales and marketing.

Service Quality

Liu and Arnett identified service quality as an important measure of Web site success [21]. In their empirical study, service quality was measured as quick

Traditional MIS success measures	e-commerce source(s)
Accuracy	Molla & Licker 2001
Relevance <ul style="list-style-type: none"> • Customer preference information 	Peppers & Rogers 1997; Molla & Licker 2001
Understandability	Molla & Licker 2001
Completeness <ul style="list-style-type: none"> • Customer information integration across multiple channels 	Zwass 1996; <i>Palmer 2002</i> ; Molla & Licker 2001
Currency	D'Ambra & Rice 2001; Molla & Licker 2001
Competitive intelligence	Teo & Choo 2001
New e-commerce success measures	e-commerce source(s)
Dynamic content	Parsons et al. 1998
Content personalization	Barua et al. 2000; Molla & Licker 2001
Variety of information	<i>Palmer 2002</i>

Table 2. E-Commerce Information Quality Measures.

Notes: Traditional MIS success measures are listed in tables 1 to 7 in DeLone & McLean [7] or were cited in MIS literature in the early to mid-1990s. Sources listed in *italics* represent empirical studies with operationalized e-commerce metrics.

responsiveness, assurance, empathy, and following-up service. Service quality can also be measured by the effectiveness of on-line support capabilities, such as answers to frequently asked questions, customized site intelligence, and order tracking [25]. None of the other e-commerce articles reviewed for this paper addressed service quality (i.e., user support). There is no debating the importance of supporting customers as they attempt to execute transactions via e-commerce systems, whether the support is offered through help desks, hotlines, service centers, or the like. It is necessary to look to the service-quality research stream for success measures that make sense in the e-commerce environment—measures such as responsiveness and technical competence.

User Satisfaction

The literature review did not reveal any e-commerce-specific instruments for measuring user satisfaction. Molla and Licker emphasize the importance of “customer e-commerce satisfaction” and define it as “the reaction or feeling of a customer in relation to his/her experience with all aspects of an e-commerce system” [25, p. 7]. Reichheld and Scheffer’s “e-loyalty” represents a good surrogate measure of customer satisfaction in the e-commerce environment [36]. Mehta and Sivadas proposed that customer attitudes are important measures of e-commerce success [24]. It is recommended here that researchers adopt and adapt user information satisfaction and end-user support satisfaction instruments as appropriate for specific e-commerce research. Some items will need to be reworded, and new items will have to be added to the traditional measurement instruments.

Nature of use	e-commerce source(s)
Information search	Young & Benamati 2000
Receiving customer orders	Young & Benamati 2000
Accepting customer payments	
Customer service requests	Young & Benamati 2000
Purchase orders	
Payments to vendors	
Amount of use	e-commerce source(s)
Number of e-commerce site visits	D'Ambra & Rice 2001; Molla & Licker 2001
Length of stay	
Number of purchases completed	

Table 3. E-Commerce System Use Measures.

System Use

As with traditional information systems [18], customer or supplier use is an important measure of success for e-commerce systems, especially because customer use is more often voluntary. The nature and amount of the usage are both important indicators of success. The usage metrics in Table 3 were found almost exclusively in the trade literature.

Net Benefits

Measures of net benefits success address the ultimate impact of the e-commerce system and therefore represent the most important category of success measurement. An e-commerce or e-business system can benefit a single user (usually a customer), a group of users, an organization, or an entire industry. Hence, the net benefits success measures found in the literature are organized by level (individual, group, organization, and industry e-commerce measures) in Tables 4 through 7. Two factors accounted for the many new e-commerce success measures identified in this section: (a) the new context—e-commerce, and (b) the new research domain—marketing research literature in addition to IS literature.

How do individual users benefit from the use of e-commerce systems? The individual benefit measures identified in the MIS and marketing literature can be found in Table 4.

The Internet and e-commerce systems enable people to work together to achieve specific objectives. How do groups of users benefit from the use of e-commerce systems? The group benefit measures identified in the MIS and marketing literature are shown in Table 5.

Some of the most important benefits from an e-commerce system accrue to the organization that invested in the system. How do organizations benefit from the use of e-commerce systems? The organization benefit measures iden-

Traditional MIS success measures	e-commerce source(s)
Enhanced customer support and services	Raghunathan & Madey 1999; Rapert & Brent 1998; <i>Griffith & Krampf 1998</i>
Improved customer knowledge	Loftus 1997
Reduced information search time	Hoque & Lohse 1999
New e-commerce success measures	e-commerce source(s)
Improved customer experience	Hoffman & Novak 1996
Entertainment	D'Ambra & Rice 2001
Reduced shopping cost	D'Ambra & Rice 2001
Real-time marketing offers	

Table 4. Individual Benefits from e-Commerce System.

Notes: Traditional MIS success measures are listed in tables 1 to 7 in DeLone & McLean [7] or were cited in MIS literature in the early to mid-1990s. Sources listed in *italics* represent empirical studies with operationalized e-commerce metrics. E-commerce measures with no citation in the right-hand column were found in the trade literature.

Traditional MIS success measures	e-commerce source(s)
Communication effectiveness	Sengupta & Zhao 1998
Improved knowledge sharing	O'Callaghan 1999
New e-commerce success measures	e-commerce source(s)
Selling team coordination	Loftus 1997

Table 5. Group Benefits from e-Commerce System.

Notes: Traditional MIS success measures are listed in tables 1 to 7 in DeLone & McLean [7] or were cited in MIS literature in the early to mid-1990s.

tified in the MIS and marketing literature can be found in Table 6. Not surprisingly, traditional organizational success measures, such as cost efficiencies, increased sales, profits, and return on investment, are suggested as key e-commerce success measures. Some measures not typically found in MIS research are proposed as well, such as global reach and click-to-buy ratio.

The Internet has facilitated interorganizational communications that have resulted in industry-level efficiencies. How do industries benefit from the use of e-commerce systems? The industry benefit measures identified in the MIS and marketing literature can be found in Table 7.

One article located in the literature search proposed economy-level measures of e-commerce success. Colecchia proposed three dimensions of success at the country level: readiness for e-commerce as measured by access and technology infrastructure; intensity as measured by e-commerce transaction volume; and impact as measured by economic-efficiency gains, employment gains, and new products and services [5].

Traditional MIS success measures	e-commerce source(s)
Growth in customer base	Peppers & Rogers 1997
Increased sales	<i>Griffith & Krampf 1998</i>
Market share	
Profit	<i>Teo & Too 2000</i>
Return on investment	Barua et al. 2001
Customer lock-in	Shapiro & Varian 1999
Competitive advantage	<i>Takacs & Freiden 1998</i>
Economies of scale	<i>Teo & Too 2000</i>
Organizational efficiency	<i>Teo & Too 2000</i> ; Barua, Whinston, & Yin 2000
Sales process efficiency	Hoffman & Novak 1997
Productivity	Barua et al. 2001
Operational excellence	Morash & Clinton 1998; Quinn 1999
Reduced cycle time	Hoogeweegen & Wagenaar 1996; O'Callaghan 1999; Barua et al. 2001
New E-commerce success measures	e-commerce source(s)
Global reach	<i>Demers & Lev 2000</i>
Customer loyalty	<i>Demers & Lev 2000</i> ; Molla & Licker 2001
Stickiness	<i>Demers & Lev 2000</i>
Brand awareness	
Customer responsiveness	<i>Teo & Too 2000</i> ; Hoogeweegen & Wagenaar 1996
Market responsiveness	<i>Teo & Too 2000</i>
Customer acquisition	<i>Gonsalves et al. 1999</i> ; Barua et al. 2001
Customer retention	<i>Parthasarathay & Bhattacharjee 1998</i>
Click-to-buy ratio	

Table 6. Organizational Benefits from e-Commerce System.

Notes: Traditional MIS success measures are listed in tables 1 to 7 in DeLone & McLean [7] or were cited in MIS literature in the early to mid-1990s. Sources listed in *italics* represent empirical studies with operationalized e-commerce metrics. E-commerce measures with no citation in the right-hand column were found in the trade literature.

New e-commerce success measures	e-commerce source(s)
Interorganizational transaction efficiency <ul style="list-style-type: none"> • Supply-chain efficiency; cost reductions throughout the supply chain 	Baron, Shaw, & Bailey 2000
Supply-chain integration, synchronization	Morash & Clinton 1998; Quinn 1999; Ünal 2000
Improved trading partner relationships <ul style="list-style-type: none"> • Virtual partnerships 	Hoogeweegen & Wagenaar 1996 Leidner 1999
Interorganizational coordination and synergy	Achrol & Kotler 1999

Table 7. Industry Benefits from e-Commerce System.

Most of the success measures found in e-commerce articles are measures already used in IS research. The major differences are context and focus. In the e-commerce environment, the system users are customers and suppliers,

and the purpose of the system is primarily the execution of business transactions. Thus, the e-commerce context does not require a new set of success metrics. The updated DeLone & McLean model can serve as an appropriate framework for organizing e-commerce success metrics.

Applying e-Commerce Success Measures: Two Case Examples

The utility of the updated DeLone & McLean IS Success Model and related e-commerce metrics can be demonstrated with two case examples. One involves a large, high-profile “bricks-and-clicks” business, and the other a small, traditional, regional retailer. The proposed e-commerce metrics are meant to be demonstrative rather than exhaustive. In other words, the two examples show how the DeLone & McLean model can be used to guide both practical and empirical success studies. Although the examples are compelling logically, the next step is to test the metrics empirically.

Case 1: Barnes & Noble

The entry of Barnes & Noble into on-line book sales in 1997 is well documented in two Harvard Business School cases entitled “Leadership Online: Barnes & Noble vs. Amazon.com” [19]. Amazon.com’s growth in sales and market value demonstrated the value of the on-line model. Customers could order from their homes. More titles were available than at brick-and-mortar bookstores, and at lower prices. Detailed customer information enabled on-line bookstores to personalize their customers’ electronic purchasing experience. Barnes & Noble decided to compete opposite Amazon.com in cyberspace. The purpose here is not to discuss this well-known case in detail but to consider the measures by which Barnes & Noble might measure the success of its e-commerce business. A proposed e-commerce success measurement model is displayed in Figure 2 using the updated DeLone and McLean framework [8, 9].

The ultimate measures of success for Barnes & Noble’s on-line book sales business are incremental sales revenue and investor reactions to the company’s “success” as reflected in its market valuation. To understand these net benefit results, the e-commerce researcher must also measure the quality of the user’s experience and the customer’s usage of, and satisfaction with, the system. The Barnes & Noble Web site must be easy to use and available whenever the customer wishes to access it. The information displayed must be relevant to the customer’s interests and must be complete. A quick e-mail response to purchase transactions is an issue of on-line service quality. If the customer’s question cannot be resolved by e-mail, then a call center should be available. Customers’ usage can be measured by the frequency of their site visits, and their satisfaction can be measured by repeat purchases. All these measures, as displayed in Figure 2, represent a comprehensive (but again, not exhaustive) success measurement model for Barnes & Noble on-line, based on the updated DeLone & McLean model.

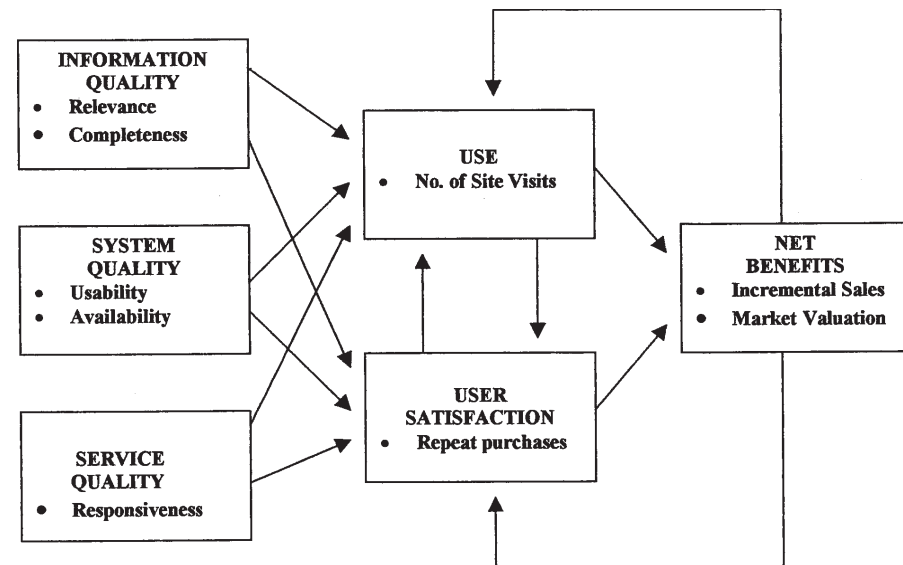


Figure 2. Barnes & Noble.com IS Success Model

Case 2: ME Electronics

ME Electronics (the company name is changed for confidentiality) is a quality consumer electronics retail chain targeting wealthy customers by offering high-end audio and video brands through nine retail stores in a large metropolitan area. ME Electronics has maintained a Web site for the past four years. The Web site supports a broad-based communications strategy and serves as a one-way communication channel to the customer, used to disseminate company information, such as new product introductions. At present, customers cannot place orders through ME's Web site. ME faces a competitive challenge from large-scale electronics retailers with fully functional e-commerce sites.

ME's e-business strategy for the near future is based on electronic customer-relationship management (ECRM). The strategy involves an interactive Web site and a comprehensive customer database that tracks all customer interactions. The value proposition involves service excellence through greater convenience, lower costs, and personalized customer service.

The purpose here is not to discuss the wisdom of this strategy but to demonstrate the utility of the updated DeLone & McLean model in an entirely different e-commerce context. How should ME Electronics measure the success of its new e-business efforts? An e-business success model for the firm is displayed in Figure 3.

The strategic objective of ME Electronics' new e-business strategy is CRM. The net benefit of this new strategy should be increased sales per customer. This benefit will be realized only if customers are satisfied with their Web site experience. They should be encouraged to periodically complete e-mail-based customer-satisfaction surveys that measure system quality (download speed and ease of use), relevance of the information found on the site, ME's respon-

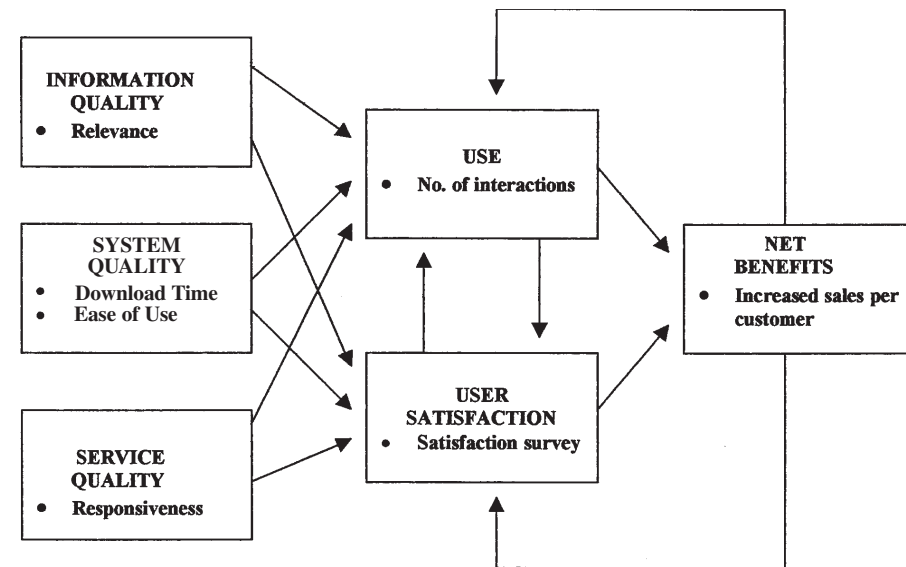


Figure 3. ME Electronics EC Success Model

siveness to customer e-mail inquiries, and overall satisfaction with the on-line experience. ME should also collect data on the number of electronic interactions with each customer and correlate interactions with sales activity. All these measures, as displayed in Figure 3, represent a comprehensive success-measurement model for ME Electronics' new e-business strategy.

These two examples demonstrate the flexibility and relevance of the updated DeLone & McLean model as a framework for measuring e-commerce success.

Conclusions and Recommendations

This paper adapts the well-established DeLone & McLean IS Success Model to the metrical challenges of the new e-commerce world [7, 8, 9]. Drawing from the IS and marketing literature published over recent years, the six dimensions of the updated DeLone & McLean model comprise a parsimonious framework for organizing the various e-commerce success metrics identified in the literature. This exercise leads to the following recommendations.

Researchers and practitioners should not let themselves be carried away by the hype of the new economy and led to believe that this new and rapidly changing environment requires entirely new measures of IS success. One should look first at the cumulative tradition, and determine which existing and validated success measures can be used in the e-commerce environment. As much as possible, tried and true measures should be enhanced and expanded with modifications or, where necessary, new measures should be considered. Selection of e-commerce success dimensions and measures should be contingent on the objectives and the context of the empirical investigation,

but tested and proven measures should be used whenever possible. Completely new and untested metrics should be adopted only as a last resort.

The multidimensional and interdependent nature of e-commerce success, as reflected in the DeLone & McLean IS Success Model, requires careful attention to the definition and measurement of every aspect of this dependent variable. It is important to measure the possible interactions among the success dimensions in order to isolate the effects of independent variables on one or more of them. Cause can too easily be confused with effect. Viewing the DeLone & McLean IS Success Model from both a process perspective and a variance perspective, as suggested by Seddon [38], can be useful in identifying and understanding these interactions.

Furthermore, despite the multidimensional and contingent nature of e-commerce success, an attempt should be made to significantly reduce the number of different measures used to measure success, so that research results can be compared and findings validated.

Finally, e-commerce studies should include net benefits measures and not be content to collect only surrogate measures, such as Web site hits (i.e., use). Such benefits can be measured on at least four levels: individual, group, organizational, and industry. Tables 4 through 7 give examples of measures for each level. Taken together, the metrics presented in this paper, and especially in the two case examples, show that a blending of well-established and new measures is needed. These measures become most useful, however, when fitted into an overall structure or framework—a framework like the one provided by the DeLone & McLean Information Systems Success Model.

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